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U.S. EPA Docket Center
Docket ID No. EPA-HQ-RCRA-2002-0033
By E-mail at RCRA-Docket@epa.gov

Dear Sirs/Mmes:

I appreciate the opportunity to comment on EPA's continuing efforts to develop a vapor intrusion guidance. In fact, I appreciate EPA's broad outreach to representatives of affected communities inviting their input. I have been learning about vapor intrusion since late 2002, when it first became an issue in my community, and it is remarkable how much the entire environmental-response universe has learned about the pathway over the last decade. To organize my comments, I am working from the questions that EPA put forward for the April 3, 2011 Feedback Session in Philadelphia.

1. What conditions might warrant a vapor intrusion investigation

Vapor intrusion investigations should begin at any sites where there is a trichloroethylene (TCE), tetrachloroethylene (PCE), or Carbon Tetrachloride (and perhaps other substances) plume in the shallow-most aquifer, as defined by the Maximum Contaminant Plume (MCL) for each contaminant. While the relationship between groundwater concentrations and indoor contamination is variable, these are the data that are typically available, and the MCL is a sufficiently good predictor of potential problems to move on to the next steps. While it is possible that the MCL for such contaminants will be lowered, that likely would be accompanied by more protective exposure standards for indoor air, so the MCL would still remain an appropriate indicator.

I am less familiar with sites with other contaminants, but I am willing to accept higher initial groundwater screening levels, such as 10 times the MCL, for compounds such as BTEX and Vinyl Chloride that normally degrade as they approach the surface.

If for some reason indoor air measurements have been conducted before a vapor intrusion investigation is initiated, levels above protective health-based standards should also initiate an investigation.

Finally, any time a sensitive use, such as a school, daycare center, housing, or correctional facility, is planned in a community with numerous uncharted ("rogue") volatile organic compound (VOC) plumes, such as New York City, it is desirable to conduct shallow groundwater and soil-gas sampling even if a plume has not yet been identified at the site. Rogue plumes are common in communities where groundwater has not been characterized because it does not serve as a drinking water source.

2. What sampling approaches are recommended?

Sampling should begin in source areas, where contamination is present in the vadose zone, in areas known to have the highest levels of contamination in shallow groundwater, and where there are sensitive uses above the contamination.

In many cases additional groundwater monitoring points should be established to better define plume boundaries. The interpolated contour lines that define plumes for protecting drinking water supplies may not be accurate enough to guide vapor intrusion investigations.

I support the Multiple Lines of Evidence approach, particularly the simultaneous measurement of sub-structure soil gas, indoor air, and outdoor air. Today such an approach is necessary, both to determine whether elevated indoor air concentrations are caused by vapor intrusion and to evaluate whether soil gas levels pose a potential for vapor intrusion should a pathway into the building open up or ventilation conditions change.

If investigators go into a building to collect sub-structure samples, there is no reason to delay indoor air sampling. It should be conducted at the same time, though perhaps not in every room at first.

If the purpose of the investigation is to screen undeveloped property before construction, soil gas and groundwater measurements are appropriate.

3. What sampling methods are preferable

The guidance should endorse conventional sampling methods, such as Summa Canisters, but it should be flexible enough to accept passive devices, such as sorbent tubes, if they are shown to be sufficiently accurate, and real-time/near-real-time devices (EPA's Trace Atmospheric Gas Analyzer, Hapsite detectors, and emerging micro-devices) as they become cost-effective. The frequency and duration of sampling should depend upon the capabilities of each device, designed to overcome temporal variation in results.

4. What considerations are important for testing indoors?

Sampling strategies should include a worst case scenario, in which the pressure differential between the subsurface and indoors is highest, and ventilation is lowest. In cold parts of the country, this is typically the heating season, but it may be different in other climates or in non-residential settings.

However, additional sampling may add value to the results. I reviewed data at one New York City school where indoor air sampling, as well as ambient outdoor testing, were conducted with the HVAC system on and again with it off. The results suggested that the source of elevated PCE levels inside was outdoor air, not the subsurface. (This was actually a case of monitoring, because a mitigation system was in place, but the lesson remains.)

While it is always important to find and remove potential indoor sources of the contaminants of concerns—that is, those known to be in the subsurface—that is not always achievable. Thus, the use of mobile real-time sampling devices to detect both pathways and indoor source is desirable where affordable. Alternatively, successive sampling with the building pressurized and depressurized may be used to determine if the source of indoor air contamination is the subsurface or an indoor source. Building occupants should be notified of indoor sources and educated about how to eliminate them, because they may pose health risks comparable to vapor intrusion.

In large buildings such as schools, commercial structures, and even row houses, where there are multiple, distinct airspaces above the same slab, it is important to conduct indoor air sampling in each airspace, because the presence of a pathway into one or two such airspaces may lead to the collection of gas from beneath the entire slab and the magnification of the vapor intrusion impact.

5. What conditions might warrant mitigation?

Mitigation should be conducted where:

a. Indoor air levels exceed health-based standards, typically the 10^{-6} excess lifetime cancer risk for the use scenario, except that the residential scenario should be used for schools and daycare centers.

b. Sub-structure soil gas levels indicate a high likelihood of future increases in indoor air concentrations. New York's Matrix approach is one way to incorporate this.

c. In areas where numerous other buildings are found to qualify for mitigation, and the cost of additional sampling approaches that of mitigation.

d. In new construction, anywhere above a shallow VOC plume, as defined by the MCL for measured contaminants. It is often appropriate to install passive systems and activate them if post-construction sampling shows a need. While EPA may be able to require such mitigation in

some cases, it should also work with other entities to incorporate such requirements into building codes, local ordinances, or other local government instruments.

6. How should temporary exceedances of indoor air criteria levels due to vapor intrusion be considered in mitigation decision-making?

Additional sampling with long-duration samplers or real-time samplers may be used to resolve the short-term exceedances, but mitigation may be appropriate where the cost of additional sampling approaches that of mitigation.

7. What considerations are appropriate for the blanket mitigation approach?

In addition to considering the blanket approach where sampling costs approach those of mitigation for additional units, EPA should listen to community concerns. At some locations, such as Dayton, Ohio, residents have lost confidence in the response because they did not understand why some residences received mitigation while neighboring ones did not.

8. What are the long-term management considerations for structures where mitigation is implemented?

There should be a tiered system of regular inspection and monitoring, where certain tasks (such as checking fans for proper operation) are conducted frequently and other tasks, such as indoor air monitoring, are conducted less frequently. Reporting should be conducted at least annually, and remedy review should be at least every five years. Such monitoring programs should be site-specific, and should be integrated with existsing custodial and property management services.

With the ubiquity of Internet connections, it may be possible to conduct real-time management. For now, the sensors would have to be pressure sensors, but soon small, inexpensive concentration detectors are likely to be available. Sensor networks can be used continuously to assure proper system operation, and it may be possible to shut off or slow down fans in a real-time response to changes in pressure and/or concentration.

9. What long-term management options should be considered for structures where mitigation is *not* implemented, such as homes where the owner chooses not to cooperate?

If possible, EPA should work with local governments to develop notification systems triggered by a change in occupancy or ownership, so new owners and occupants can be given the opportunity to cooperate.

10. What options should be considered for new construction above or near known plumes?

EPA should work with local governments to ensure that new construction or significant remodeling above or near shallow VOC plumes will trigger an evaluation of the need for vapor intrusion investigation and mitigation. My city of Mountain View, California has such a program,

based upon the California Environmental Quality Act for large projects and Mountain View's permitting system for smaller projects.

11. What mitigation approaches are preferable?

EPA should be flexible, because new information is being developed on the efficacy of various approaches, but for now sub-structure depressurization should remain the default approach. Likely or proven pathways should be sealed, as well. The operation of heating, ventilation, and air conditioning systems may be operated as mitigation if verified with monitoring and managed to ensure that they operate when necessary.

12. How should actual or potential vapor intrusion impact groundwater cleanup requirements and strategies?

Removing the subsurface sources of actual or potential indoor vapors is the most reliable way to prevent vapor intrusion. In cases remediation may take many years, or even decades, but remedial systems should be re-evaluated at vapor intrusion sites to accelerate removal or treatment and to prevent contamination from spreading under structures. Mitigation should continue and be monitored so that it operates as long as subsurface contamination poses a risk of vapor intrusion.

This is particularly important where building owners do not cooperate with sampling and/or mitigation. Even the best system of notifying and working with new owners and occupants will have loopholes, so the best way to ensure protection is to permanently remove the cause.

13. What actions are appropriate for temporary exceedances of indoor air criteria levels?

Exceedances should trigger either additional monitoring or the enhancement of mitigation systems. In fact, confirmed exceedances should trigger the implementation of a contingency plan that would quickly lead to system improvement.

14. What performance criteria and monitoring plans are recommended for mitigation systems?

See answer 13. Site management plans should be announced and available to the public. Monitoring data should be transparent and understandable, so that property owners, residents, and other occupants can determine whether performance standards are indeed being met.

Petroleum Releases

I have less experience with petroleum compounds, but I recognize that there are locations where they do migrate into buildings at unacceptable levels. The general approach to petroleum

vapor intrusion should be similar to that of chlorinated compounds, but screening levels should be adjusted to account for the likely degradation of compounds as they mix with oxygen and verified high ambient outdoor concentrations.

Community Engagement

Several times in the past I have provided suggestions to EPA about vapor intrusion public involvement, so here I will simply summarize key points.

- *Intrusion* is an appropriate term, so expect people to be upset. The likelihood of perhaps temporary drops in property values as well as health threats means that initial communications will be touchy and difficult.

- Trusting relationships among EPA, responsible parties, and the owners and occupants of impacted buildings is imperative because owners and occupants can essentially veto investigation and/or mitigation. EPA should defer, where possible, to the preferences of these people.

- Initial notice of a vapor intrusion investigation should be both to impacted people (owners, occupants, and their family members of children) and to the public at large. But no one should hear first about a problem in his/her home or school from the mass media.

- Proven community involvement strategies, relying on advisory groups and independent technical consultants, can help the public to understand vapor intrusion and to provide constructive input. Vapor intrusion *is* "rocket science." It normally takes more than one session for most people to understand concepts such as attenuation, multiple lines of evidence, and temporal and spatial variability, let along the unfamiliar units and risk measurements associated with vapor intrusion.

- Some communities, such as immigrant populations, may be particularly unwelcoming to government or responsible-party investigators. Where that happens, EPA should partner with ethnic community organizations, churches, and others, to establish trust and heighten cooperation.

Sincerely,

Lenny Siegel
CPEO Executive Director